Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 119)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 + 5x^4 + 9x^3 - 3x^2 - 7$$
$$q(x) = 7x^5 - x^4 + 3x^3 + 9x + 10$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-8)x^5 + (5)x^4 + (9)x^3 + (-3)x^2 + (0)x^1 + (-7)x^0 \\
q(x) &= (7)x^5 + (-1)x^4 + (3)x^3 + (0)x^2 + (9)x^1 + (10)x^0 \\
q(x) - p(x) &= (15)x^5 + (-6)x^4 + (-6)x^3 + (3)x^2 + (9)x^1 + (17)x^0 \\
q(x) - p(x) &= 15x^5 - 6x^4 - 6x^3 + 3x^2 + 9x + 17
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 + 5x - 2$$
$$b(x) = 5x - 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$5x$	-2
$5x$	$-30x^3$	$25x^2$	$-10x$
-3	$18x^2$	$-15x$	6

$$a(x) \cdot b(x) = -30x^3 + 25x^2 + 18x^2 - 10x - 15x + 6$$

Combine like terms.

$$a(x) \cdot b(x) = -30x^3 + 43x^2 - 25x + 6$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -x^3 + 7x^2 + 3x - 11 \\ g(x) &= x - 7 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-7}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	-1	7	3	-11
7		-7	0	21
	-1	0	3	10

So,

$$\frac{f(x)}{g(x)} = -x^2 + 3 + \frac{10}{x-7}$$

In other words, $h(x) = -x^2 + 3$ and the remainder is $R = 10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -x^3 + 7x^2 + 3x - 11$. Evaluate $f(7)$.

You could do this the hard way.

$$\begin{aligned} f(7) &= (-1)\cdot(7)^3 + (7)\cdot(7)^2 + (3)\cdot(7) + (-11) \\ &= (-1)\cdot(343) + (7)\cdot(49) + (3)\cdot(7) + (-11) \\ &= (-343) + (343) + (21) + (-11) \\ &= 10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(7)$ equals the remainder when $f(x)$ is divided by $x - 7$. Thus, $f(7) = 10$.